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KOREANURINA NEW GENUS, *LEENURINA* NEW GENUS AND *CAPUTANURINA* LEE, 1983 (COLLEMBOLA: NEANURIDAE) FROM NORTH KOREA

JUDITH NAJT[1] AND WANDA MARIA WEINER[2]

[1]Centre National de la Recherche Scientifique, Laboratoire d'Entomologie, Muséum national d'Histoire naturelle, Paris

[2]Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Cracow, Poland

Abstract.—Materials of Neanuridae, Collembola from North Korea were studied. *Koreanurina* NEW GENUS and *Leenurina* NEW GENUS are described, and their taxonomic positions are determined. The genus *Caputanurina* Lee, 1983 is redescribed. Several new species are also described: *Koreanurina szeptyckii* NEW SPECIES, *K. inexpectata* NEW SPECIES, *Leenurina jasii* NEW SPECIES, *Caputanurina intermedia* NEW SPECIES, *C. turbator* NEW SPECIES, *C. major* NEW SPECIES and *C. sexdentata* NEW SPECIES.

Key Words.—Collembola, *Koreanurina, Leenurina, Caputanurina,* North Korea, taxonomy

In 1983, Lee created the subfamily Caputanurinae for two South Korean species with extraordinary characters: the fusion of thorax I with the base of the head; the displacement of the head, anteriorly, and of the abdominal segments, posteriorly, resulting in a pronounced "cryptophthalmy" and distinct "cryptopygy." Also, the cuticule exhibits strong tegumental granulation.

According to Lee (1983), the subfamily contains only one genus, *Caputanurina* Lee, 1983; *C. serrata* Lee, 1983 and *C. nana* Lee, 1983 differ mainly in chaetotaxy, in the form of tegumental grains, as observed with a scanning electron microscope, and in the position of the eyes and the postantennal organ.

Our study, undertaken in 1985, is based on the materials collected in 1971, 1974 and 1981 by the expeditions of the Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Cracow, Poland. This material included species belonging to *Caputanurina* and to some related groups, and thus enabled us to taxonomically place these species more precisely in relation to the already known subfamilies of Neanuridae.

We also include *Koreanurina* NEW GENUS, related to a species of *Anurida* Laboulbène, 1865, although we consider *Leenurina* NEW GENUS to belong to the Caputanurinae. A discussion of each genus is presented below.

Abbreviations.—ISEA: Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Cracow, Poland; MNHN: Laboratoire d'Entomologie, Muséum national d'Histoire naturelle, Paris, France.

PSEUDACHORUTINAE SENSU MASSOUD, 1967

KOREANURINA NAJT & WEINER, NEW GENUS

Type Species.—*Koreanurina szeptyckii* NEW GENUS, NEW SPECIES.

Description.—Color light blue, dark blue, gray. Eyes and postantennal organ dorsal, latter with 9–11 vesicles in one row circle. Five-tooth mandibles. Maxillae type as in *Anurida,* with dentate maxillary

capitulum, free lamellae. Labium elongate, papillary L seta absent, labial organite (x) present. Labral chaetotaxy two/two, three, five, two. Antennae short. Antenna I with seven setae, antenna II with 11 setae. Antennae III and IV fused dorsally. Sensory organ of antennal segment III consisting of two microsensillae, two guard sensillae (the ventral one s-shaped) and one ventrolateral microsensilla. Antenna IV with six thick, subcylindrical sensillae and small dorsal external sensilla; subapical organite small but distinct; apical vesicle slightly bilobate; no sensory rasp. Ventral tube with four + four setae. Tibiotarsus with 18, 18, 17 setae; claw toothless. Furca vestigial, reduced to two small mamelons, each with one seta. Thorax I well separated. Abdomen VI ventral. No anal spines. Dorsal reticulation present on head, thorax II, III and abdomen I to V.

Diagnosis.—The presence of dorsal reticulation on head and thorax tergites II–III make it easy to discern *Koreanurina.* Table 2 presents the characters differentiating *Koreanurina* from *Leenurina* and *Caputanurina.*

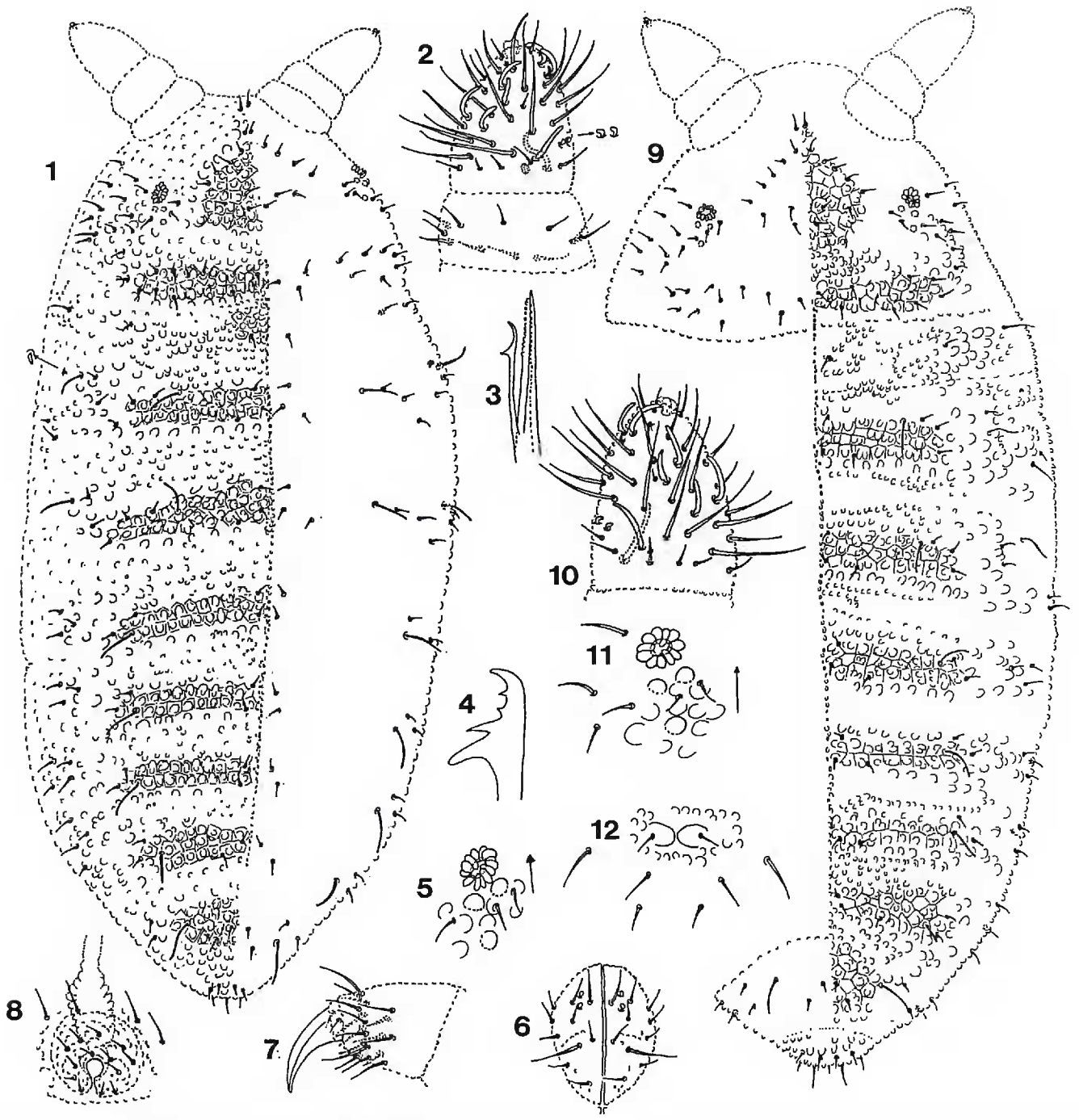
Discussion.—We included *Koreanurina* among the Pseudachorutinae because of the presence of six sensillae on antenna IV. The new genus has a well-separated thorax I, like in all other genera of the subfamily, which was divided by Massoud (1967) into two tribes. *Koreanurina* is, however, related to a single *Anurida* species (*A. hexophthalmica* Stach, 1949 of the Tatra Mts, Poland) in its habitus, buccal parts type, number and position of the eyes and the postantennal organ, the furca, "oligochaetosis," and abdomen segment VI, which is hidden under segment V.

Material Examined.—See *K. szeptyckii.*

Koreanurina szeptyckii Najt & Weiner, NEW SPECIES
(Figs. 1–8)

Types.—Holotype: female; data: NORTH KOREA. *NORTH PYONGAN PROVINCE:* Myohyang-san Mts, nr Habiro waterfall, fresh litter in oak-maple-pine forest, 25 Jun 1981, A. Szeptycki & W. M. Weiner. Allotype, male, same data as holotype. Holotype and allotype deposited in Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Cracow, Poland. Paratypes, 9 specimens; 8 deposited in ISEA, 1 deposited in MNHN.

Description.—Female (holotype) length 0.44 mm, male (allotype) length 0.38 mm, paratypes length 0.42 and 0.46 mm. Color in alcohol spotted light blue for females, dark blue for males, ocular plate blue-black. Tegumental grain very strong. Dorsal reticulation hexagonal or square on head: a plate on vertex and two rows on seta c and p level; thorax II, III and abdomen I–V in two or three rows (Fig. 1). Antennae shorter than head. Antennal segment I with seven setae, antennal segment II with 11 setae. Antennae III and IV fused dorsally, ventral separation well-marked with very fine tegumental granulation. Sensory organ of antennal segment III consisting of: (a) two small sensillae bent in same direction without tegumental fold, (b) two subcylindrical guard sensillae (ventral s-shaped/bent in squashed specimens/very long compared with dorsal), (c) small ventrolateral sensilla in small groove. Antennal segment IV with six distinct subcylindrical thick sensillae, small dorsal external sensilla; subapical organite small, distinct; apical vesicle slightly bilobate, some ordinary setae with blunt apex (Fig. 2). Ocelli three + three. Postantennal organ 3.0–4.0× larger than ocellus, bearing 9–11 vesicles arranged in circle (Fig. 5). Labium elongate (Fig. 6), setae: L papillary and B absent, two + two labial organites (x) arranged one above the other on internal side of setae C and D. Labral chaetotaxy two/two, three, five, two. Mandibles with five teeth (Fig. 4), maxilla styliform with two lamellae, one styliform, the other with two teeth, and elongate maxillary capitulum with about 12 teeth (Fig. 3). Tibiotarsi I, II, III with 18, 18, 17 setae, with one pointed tenent hair and toothless claws (Fig. 7). Thorax sternites without setae. Ventral tube with four + four setae, one specimen with four + three; three + three in immature specimens. Vestigial furca reduced to two small mamelons, each with one seta. Male genital plate is presented in Fig. 8. Dorsal chaetotaxy (Fig. 1): short thin ordinary setae and thin long sensory setae with blunt apex, but setae on abdomen IV thicker, shorter than the others. Sensory chaetotaxy is "022/11111" per one-half tergite.



Figures 1–12. Figures 1–8. *Koreanurina szeptyckii* NEW GENUS, NEW SPECIES. Figure 1. Chaetotaxy and dorsal reticulation. Figure 2. Antennae III–IV. Figure 3. Maxillae. Figure 4. Mandible. Figure 5. Ocelli and postantennal organ. Figure 6. Labium. Figure 7. Leg II. Figure 8. Male genital plate. Figures 9–12. *Koreanurina inexspectata* NEW SPECIES. Figure 9. Chaetotaxy and dorsal reticulation. Figure 10. Antennae III–IV. Figure 11. Ocelli and postantennal organ. Figure 12. Vestigial furca.

Diagnosis.—*Koreanurina szeptyckii* can be distinguished by some morphological characters: the apical vesicle slightly bilobate, two + two setae between sensory setae on abdomen I to IV, the very long ventral guard sensilla of antenna III, short sensillae on antenna IV and the ratio of diameters of PAO to ocellus (Table 1).

Etymology.—Dedicated, as a token of friendship, to Andrzej Szeptycki.

Material Examined.—See types. In addition: NORTH KOREA. *NORTH PYONGAN PROVINCE:* Myohyang-san Mts, nr Sangwon waterfall, moss on granite in an oak-maple forest, 24 Jun 1981, A. Szeptycki & W. M. Weiner, 1 specimen.

Koreanurina inexspectata Najt & Weiner, NEW SPECIES
(Figs. 9–13)

Types.—Holotype, female; data: NORTH KOREA. *KANGWON PROVINCE:*

Table 1. Characters differentiating *Koreanurina szeptyckii* NEW SPECIES from *K. inexspectata* NEW SPECIES.

Characters	*Koreanurina*	
	szeptyckii NEW SPECIES	*inexspectata* NEW SPECIES
Apical vesicle	slightly bilobate	distinctly trilobate
Number of setae between sensory setae on abd. I to IV	2 + 2	3 + 3
Guard sensillae of antenna III	differing in length, ventral one very long	almost equal
Antenna IV sensillae	short	long
PAO/ocellus ratio	3–4:1	2–2.5:1

Kumgang-san Mts, nr Kuryong waterfall, rock with bushes, herbs and mosses (litter and moss), 29 Jun 1981, A. Szeptycki & W. M. Weiner; deposited in Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Cracow, Poland. Paratypes, 2 specimens, same data as holotype: 1 immature female deposited in ISEA, 1 female deposited in MNHN.

Description.—Female (holotype) length 0.50 mm, female (paratype) length 0.54 mm. Color in alcohol light gray, ocular plate black. Very strong tegumental granulation. Dorsal reticulation present as in *Koreanurina szeptyckii* (Fig. 9). Antennae shorter than head. Antennal segment I with seven setae, antennal segment II with 11 setae. Sensory organ of antennal segment III consisting of: (a) two small sensillae slightly bent in same direction without tegumental fold, (b) two almost even, subcylindrical sensillae, (c) small ventrolateral sensilla in small groove. Antennal segment IV with six distinct subcylindrical long slender sensillae; small dorsal external microsensilla; subapical organite distinct; apical vesicle visibly trilobate (Fig. 10). Ocelli three + three. Postantennal organ, 2.0–2.5 × larger than ocellus diameter, bearing 11 vesicles arranged in circle (Fig. 11). Labrum, labium, maxillae and mandibles similar to those in *Koreanurina szeptyckii.* Tibiotarsi I, II, III with 18, 18, 17 setae including one pointed tenent hair, claw toothless. Thoracic sternites without setae. Ventral tube with four + four setae. Abdominal sternites II and III without odd seta. Vestigial furca reduced to two small mamelons with one seta each (Figs. 12 and 13). Female genital plate is presented in Fig. 13. Dorsal chaetotaxy is presented in Fig. 9. Sensory chaetotaxy is "022/11111" per one-half tergite.

Diagnosis.—*Koreanurina inexspectata* is distinguished by three + three setae on the abdominal tergites I to IV and very long sensillae on the antennal segment IV. We present the differences between the two species of *Koreanurina* in Table 1.

Etymology.—The name comes from the Latin word for "unexpected."

Material Examined.—See types. In addition: NORTH KOREA. *KAESONG-SI PROVINCE:* Chonma-san Mts, nr Pakyon waterfall, maple-oak forest; litter, 15 Jul 1981, A. Szeptycki & W. M. Weiner, 1 specimen.

Caputanurinae Lee, 1983

In this subfamily, closely related to the Pseudachorutinae, we describe *Leenurina* NEW GENUS with two species; we redefine *Caputanurina* Lee, 1983, in which we include three new species.

This subfamily is mainly characterized by the absence of a well-defined thoraxic tergite I; it seems to be fused with the base of the head, where the two + two dorsolateral setae might be a remnant of prothorax chaetotaxy.

Leenurina Najt & Weiner, NEW GENUS

Type Species.—*Leenurina jasii* NEW GENUS, NEW SPECIES.

Table 2. Characters differentiating the genera: *Koreanurina* NEW GENUS, *Leenurina* NEW GENUS and *Caputanurina* Lee, 1983.

Characters	Pseudachorutinae	Caputanurinae	
	Koreanurina NEW GENUS	*Leenurina* NEW GENUS	*Caputanurina* Lee, 1983
Prothorax tergite	well defined	fused with head	fused with head
Eye position	dorsal	dorsal	dorsolateral or lateral
Postantennal organ	dorsal	dorsal	lateroventral or ventral
Head	normal	normal	with a V-like stitch along the whole vertex[a]
Abdomen V	normal	normal	inverted V-like
Habitus	normal	normal	dorsally flattened
Development of dorsal reticulation	+	++	+++
Antennal segment II setae	11	12	12–13
Dorsal setae present on thorax II–III	a1, p1, p2, p5 = s	a1, m1, p1, p5 = s	a1, p1, p2, p5 = s
Dorsal setae present on abdomen I–III	a1, p1, p5 = s or a1, p1, p2, p5 = s	a1, p1, p3, p5 = s	a1, p1, p2, p5 = s

[a] With one exception: *C. intermedia.*

Description.—Color blue or orange in live individuals. Eyes and postantennal organ dorsally. Ocelli two + two or three + three on well-defined plate with reticulation and strong granulation. Postantennal organ with 9–14 vesicles arranged in one row circle or oval. Mandibles with five teeth. Maxillae of the type *Anurida hexophthalmica* with two pointed styliform lamellae or tooth and maxillary capitulum with many small teeth. Labium short, papillary L seta absent, labial organite (x) present. Labral chaetotaxy: two/two, three, five, two. Antennae short. Antenna I with seven setae. Antenna II with 12 setae. Antennae III and IV fused dorsally. Sensory organ of antenna III built of two microsensillae, two almost even, subcylindrical guard sensillae and ventrolateral microsensilla. Antenna IV with six thick subcylindrical sensillae and a small dorsal external sensilla, subapical organite distinct, apical vesicle bi- or trilobate, sensory rasp absent. Ventral tube with four + four setae. Tibiotarsi with 18, 18, 17 setae, claws toothless. Vestigial furca reduced to two setae, with two mamelons or without protuberance (Lee, 1983). No anal spines. Head developed normally. Thoraxic tergite I fused at base of head, sternite developed normally. Abdomen VI in ventral position. No setae on thorax sternites, no odd setae on abdominal sternites II and III. Dorsal chaetotaxy consists of short and pointed ordinary setae and thin sensory setae. Very strong tegumental granulation. Reticulation on head, thorax II and III and abdomen I through V.

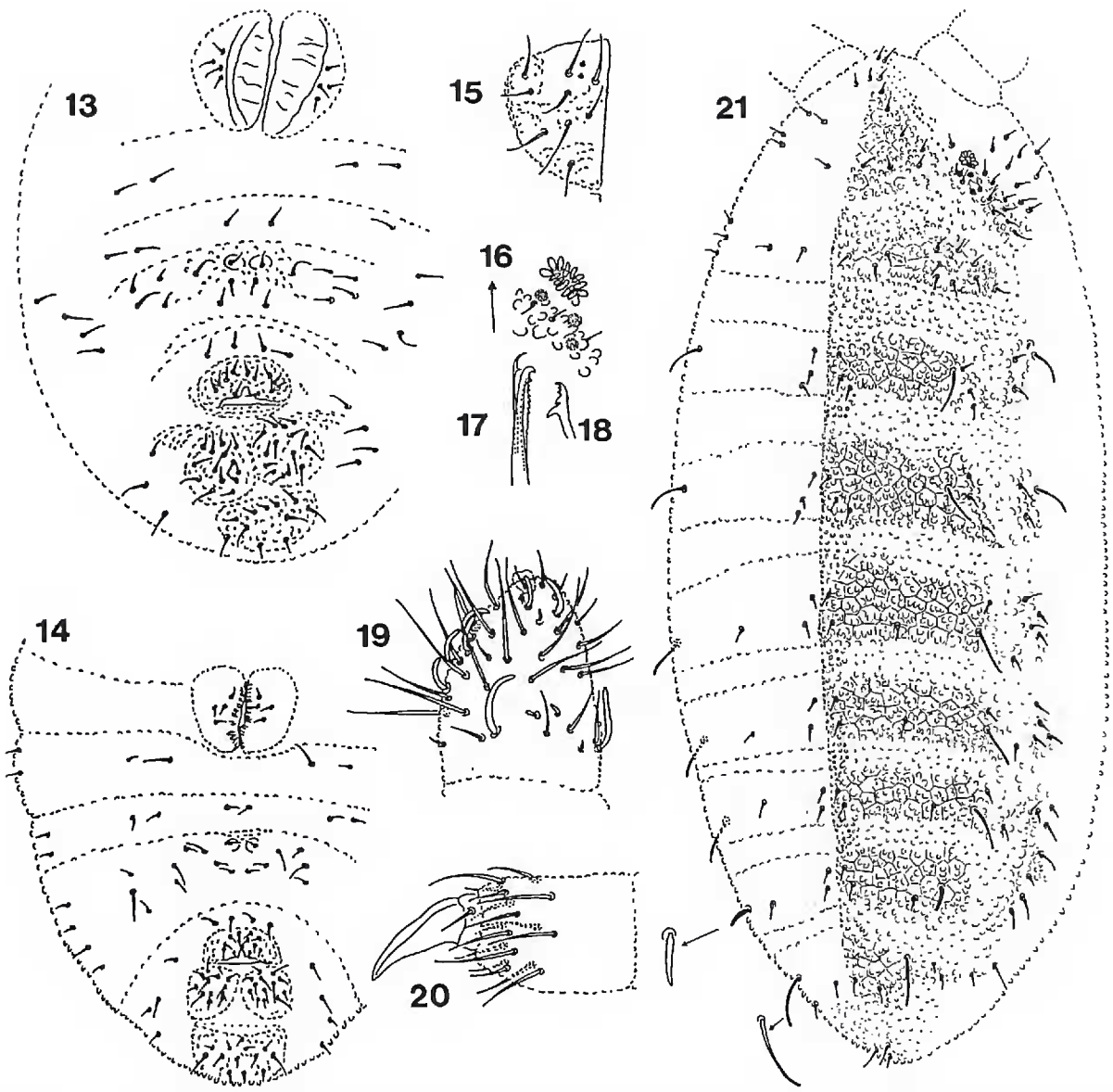
Diagnosis.—The new genus is close to *Koreanurina* and *Caputanurina.* We present their main differentiating characters in Table 2.

Etymology.—The new genus is dedicated to our Korean friend and colleague, B. H. Lee.

Material Examined.—See *L. jasii.*

Leenurina jasii Najt & Weiner, NEW SPECIES
(Figs. 14–21)

Types.—Holotype, female; data: NORTH KOREA. *KANGWON PROVINCE:* Kumgang-san Mts, nr Kuryong waterfall, gorge of stream, with bushes, herbs and oak (litter), 1 Jul 1981, A. Szeptycki & W. M. Weiner; deposited in Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Cracow,



Figures 13–21. Figure 13. *Koreanurina inexspectata* NEW SPECIES, abdominal segment I–VI. Figures 14–21. *Leenurina jasii* NEW GENUS, NEW SPECIES. Figure 14. Abdominal sternites I–VI. Figure 15. Labium. Figure 16. Ocelli and postantennal organ. Figure 17. Maxillae. Figure 18. Mandible. Figure 19. Antennae III–IV. Figure 20. Leg III. Figure 21. Chaetotaxy and dorsal reticulation.

Poland. Paratypes, 2 specimens, same data as holotype: 1 deposited in ISEA, 1 deposited in MNHN.

Description.—Female (holotype) length 0.56 mm, immature paratypes length 0.41–0.52 mm. Color in alcohol light blue. Ocular plate blue-black. Very strong tegumental granulation. Dorsal reticulation on head (central plate of vertex, dorsolateral plates, two plates in posterior part), thorax II and III and abdomen I through V. Prothorax tergite I unmarked (Fig. 21). Antennae shorter than head. Antennal segment I with seven setae, antennal segment II with 12 setae. Sensory organ on antennal segment III consisting of: (a) two small sensillae arranged in same direction without tegumental fold, (b) two long, almost even, subcylindrical guard sensillae, (c) small ventrolateral sensilla without groove. Antennal segment IV with six thick subcylindrical sensillae, small dorsal external sensilla; small subapical organite distinct, apical vesicles slightly bilobate, all ordinary setae with pointed apex (Fig. 19). Three + three ocelli with tegumental granulation of equal size. Postantennal organ oval, 4× longer and twice broader than ocellus, with 11–14 vesicles (Fig. 16). Labium short: no papillary L seta and B seta, labial organite (x) present as two + two small hyaline vesicles arranged one above the other (Fig. 15) between A and C setae (Fig. 18). Labral chaetotaxy: two/two, three, five, two. Mandible with five teeth, the basal one very strong (Fig. 18); maxillae with two lamellae, each with two apical teeth, and maxillary capitulum with 8–11 teeth (Fig. 17). Tibiotarsi I, II, III with 18, 18, 17 setae, including one pointed tenent hair, toothless claws, well-developed thorax sternites, without setae (Fig. 20). Ventral tube with four + four setae. Abdominal sternites II and III without odd setae. Vestigial furca reduced to two small mamelons, each with one seta (Fig. 14). Female genital plate is presented in Fig. 14. Dorsal chaetotaxy (Fig. 21): thin short pointed ordinary setae and long thin sensory setae with blunt

Table 3. Characters differentiating *Leenurina jasii* NEW SPECIES from *Leenurina nana* (Lee, 1983).

Characters	*Leenurina*	
	jasii NEW SPECIES	*nana* (Lee, 1983)
Color	light blue in alcohol	orange live
Number of ocelli	3 + 3	2 + 2
Number of vesicles and shape of postantennal organ	11–14, oval	11, in circle
Number of setae between abdomen IV sensory setae	a1, p1, p4,[a] p5 = s	a0, a1, a3, p1, p2, p5 = s
Vestigial furca	2 mamelons with 1 + 1 setae	without mamelon with 1 + 1 setae

[a] Variability of p4: cf. text.

apex, 4–5× longer than ordinary setae except shorter thicker setae of abdomen IV. Sensory chaetotaxy is "022/11111" per one-half tergite. Number of setae between sensory ones of IVth abdominal segment varies from three + three to three + two to two + three.

Diagnosis.—*Leenurina jasii* can be distinguished particularly by chaetotaxic characters on the abdominal tergite IV, the color of the body and number of ocelli (Table 3).

Discussion.—At present the new genus contains two species: *Leenurina nana* (Lee, 1983) and *L. jasii*. Table 3 shows the main differentiating characters. It should be stressed that *L. nana* had been described as a species belonging to the genus *Caputanurina*; we are of the opinion that it fits well to *Leenurina*.

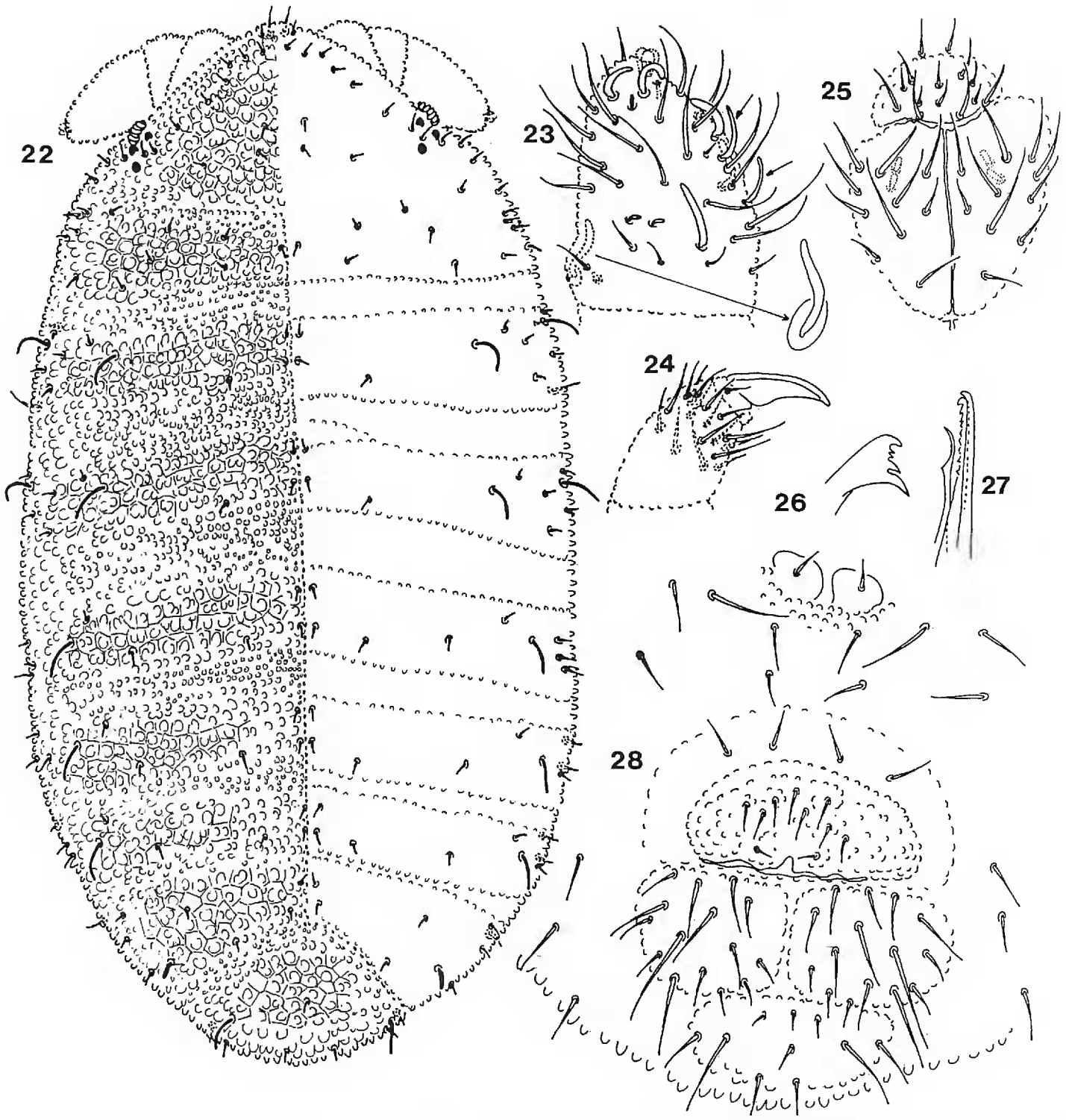
Etymology.—The species is tenderly dedicated to the son of one of us, Jaś—January M. Weiner.

Material Examined.—See types. In addition: NORTH KOREA. *KANGWON PROVINCE:* Kumgang-san Mts, Ou-Kumgang, oak-pine forest, litter on rock, 30 Jun 1981, A. Szeptycki & W. M. Weiner, 1 specimen; Valley leading to Kuryong waterfall, groves with oak, pine and reed, litter, 1 Jul 1981, A. Szeptycki & W. M. Weiner, 1 specimen; Samil-pho lake, pine-oak groves, litter with mosses and decayed herbs, 3 Jul 1981, A. Szeptycki & W. M. Weiner, 1 specimen. *NORTH HAMGYONG PROVINCE:* Chuulonpho-ri, valley with oak-lime forest, under stone, 24 May 1974, A. Szeptycki, 1 specimen.

Caputanurina Lee, 1983

Type Species.—*Caputanurina serrata* Lee, 1983.

Description.—Color in alcohol blue, white or gray. Postantennal organ lateroventral or ventral with 11–14 vesicles arranged in one row circle. Eyes dorsal or laterodorsal, two + two or three + three ocelli. Mandibles with four to six teeth. Maxillae of the type of *Anurida hexophthalmica* with two free lamellae and clearly dentate maxillary capitulum. Labium short, no papillary L seta, labial organite (x) present. Labral chaetotaxy two/two, three, five, two. Antennae short. Antenna I with seven setae, antenna II with 12–13 setae. Antennae III and IV fused dorsally. Sensory organ on antenna III composed of two microsensillae, two subcylindrical, almost equal guard sensillae and one ventrolateral microsensilla. Antenna IV with six subcylindrical sensillae, small dorsal external sensilla, small subapical organite little- or well-distinct, apical vesicle bi- or trilobate without sensory rasp. Ventral tube with four + four setae. Tibiotarsi I, II, III with 18, 18, 17 or 19, 19, 18 setae, claws toothless or with one tooth. Vestigial furca reduced to one + one or two + two setae on two mamelons. No anal spines. Body oval, strongly flattened dorsoventrally. Thoracic tergite I fused with base of head, distinct sternite of thorax I. Thoracic sternites without setae. Head and abdomen V ogive- or V-like (abdomen V inverted V-like) except in *C. intermedia* NEW SPECIES. Position of abdomen VI completely ventral.



Figures 22–28. *Caputanurina intermedia* NEW SPECIES. Figure 22. Chaetotaxy and dorsal reticulation. Figure 23. Antennae III–IV. Figure 24. Leg III. Figure 25. Labrum and labium. 26. Mandible. Figure 27. Maxillae. Figure 28. Abdominal sternites I–VI.

Strong tegumental granulation. Dorsal reticulation present from head to abdomen V, except on intersegments.

Diagnosis.—*Caputanurina* is easy to discern by the head with a V-like stitch along whole vertex (with one exception), the abdomen V inverted V-like, eyes in the dorsolateral or lateral position, the postantennal organ in the lateroventral or ventral position, the habitus dorsally flattened and the very strong dorsal reticulation. The main differentiating characters of *Koreanurina, Leenurina* and *Caputanurina* are presented in Table 2.

Caputanurina intermedia Najt & Weiner, NEW SPECIES
(Figs. 22–28)

Types.—Holotype, female; data: NORTH KOREA. *NORTH HAMGYONG PROVINCE:* Susong-chon river bank, W of Chongjin, young pine forest with

small oaks and hazels, under stones, 22 May 1974, A. Szeptycki; deposited in Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Cracow, Poland. Paratypes, 3 specimens, same data as holotype; 2 deposited in ISEA, 1 deposited in MNHN.

Description.—Female (holotype) length 0.47 mm, paratypes length 0.40–0.54 mm. Color: dark blue. Very strong tegumental granulation. Dorsal reticulation (Fig. 22) arranged in areas as follows: median and dorsolateral areas on head; areas of two to three rows of reticulation from thorax II to abdomen IV, dorsomedian area on abdomen V; each hexagon exhibits one or two large secondary granulations on the surface (cuticule). No V-like stitch on head, frontal region elongate. Antennae shorter than head. Antennal segment I with seven setae, antennal segment II with 12 setae. Sensory organ on antennal segment III consisting of: (a) two small sensillae bent in same direction, (b) two guard sensillae of differing length (ventral one shorter and s-shaped), (c) small ventrolateral sensilla with large base, ordinary ventral internal setae short. Antennal segment IV with six sensillae: four thick, two long very thin; small dorsal external sensilla; subapical organite small, distinct; apical vesicle clearly trilobate (Fig. 23). Ocelli three + three situated dorsally, postantennal organ lateral with 14–15 vesicles in single row. Buccal cone short. Labium without L and B setae, labial organite (x) consists of two + two hyaline sensillae situated internally in comparison with C and D setae (Fig. 25). Mandibles with five teeth (Fig. 26). Maxillae of *Anurida*-type, maxillary capitulum with 8–11 teeth and two lamellae: one long with bent apex, other shorter, thin, with two teeth (Fig. 27). Tibiotarsi I, II, III with 18, 18, 17 setae. Claws toothless. Femur with very long ventral seta (Fig. 24). Ventral tube with four + four setae. Vestigial furca reduced to two small mamelons each with one seta (Fig. 28). Female genital plate is presented in Fig. 28. Dorsal chaetotaxy as in Fig. 22. Sensillary formula is "022/11111" per one-half tergite. Interestingly, sensillae on abdomen IV are shorter and thicker than elsewhere.

Diagnosis.—*Caputanurina intermedia* is very characteristic by the presence of three + three ocelli and by the absence of V-like stitch on the head. Table 4 shows the differentiating characters of the new species from the other species of the genus.

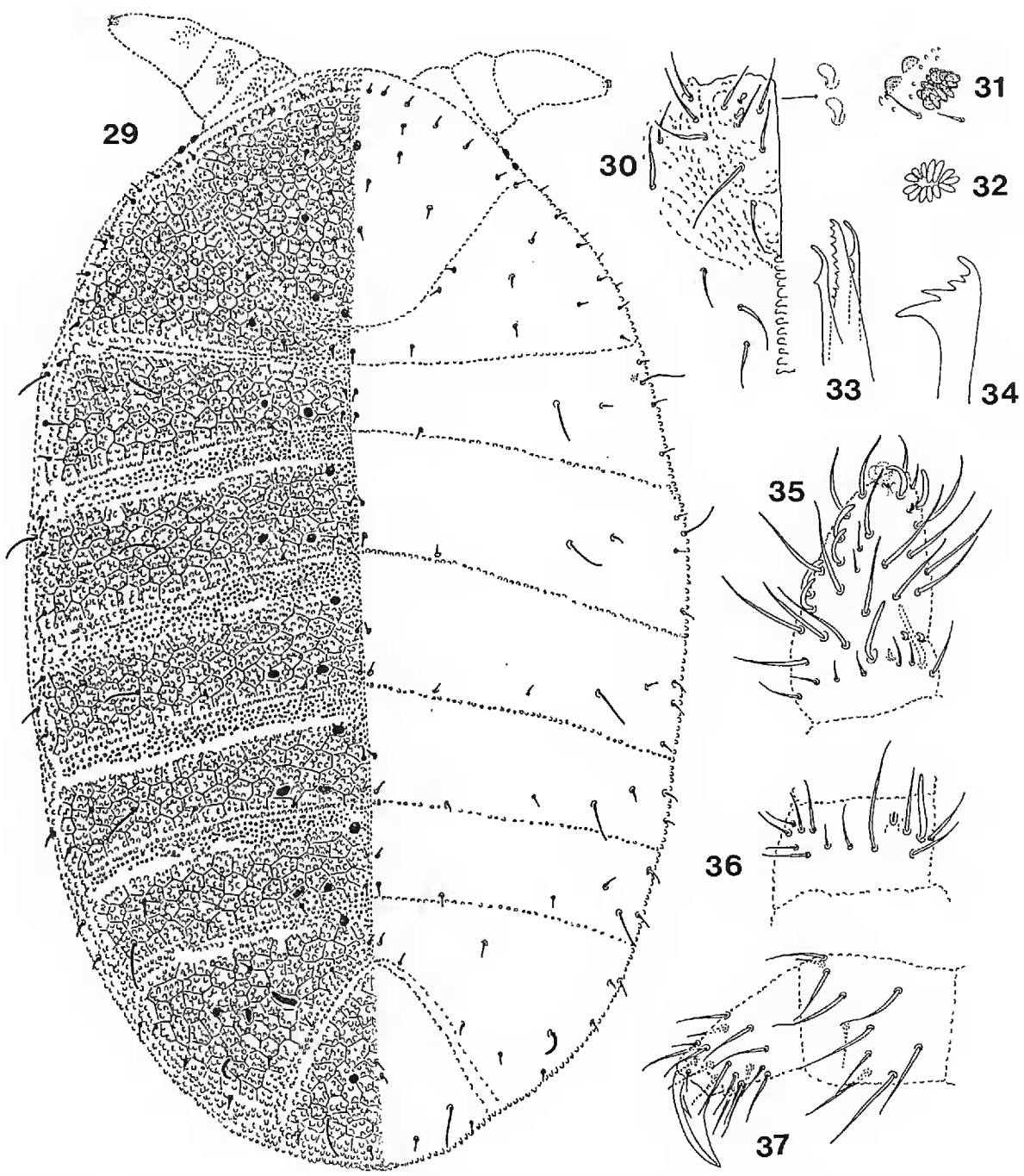
Etymology.—The name reflects the species' intermediate systematical position between *Leenurina* and *Caputanurina.*

Material Examined.—See types. In addition: NORTH KOREA. *SOUTH PYONGAN PROVINCE:* Paeksong-ri, forest with oaks, chestnuts, acacias, rhododendrons; litter with oak leaves and pine needles, 15 Jun 1981, A. Szeptycki & W. M. Weiner, 1 specimen.

Caputanurina turbator Najt & Weiner, NEW SPECIES
(Figs. 29–42)

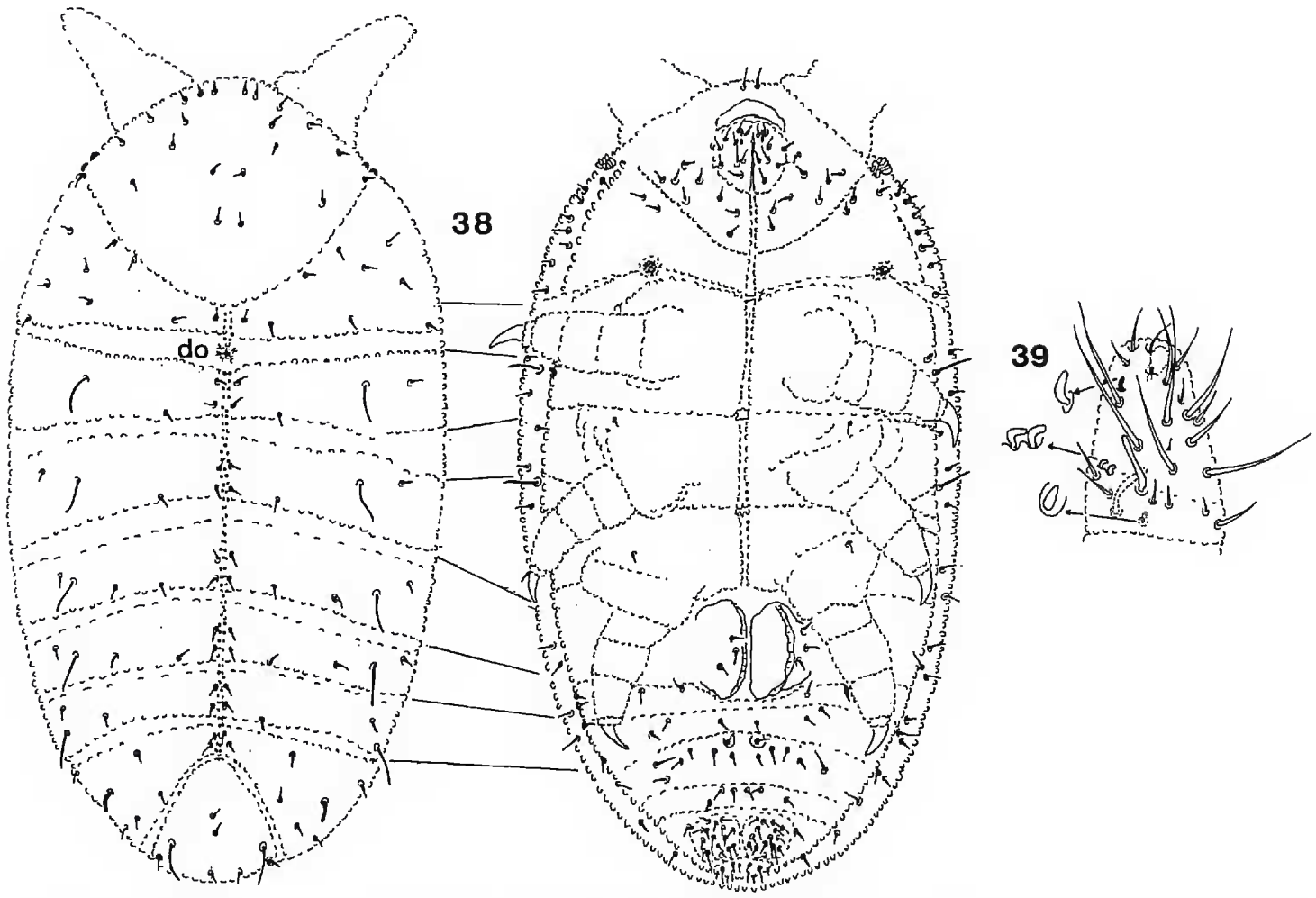
Types.—Holotype, male; data: NORTH KOREA. *NORTH PYONGAN PROVINCE:* Myohyang-san Mts, nr Habiro waterfall, oak-maple-pine forest, fresh litter, 25 Jun 1981, A. Szeptycki & W. M. Weiner. Allotype, female; same data as holotype. Holotype and allotype deposited in Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Cracow, Poland. Paratypes, 32 specimens, same data as holotype; 17 on slides and 10 in alcohol in ISEA, 5 in MNHN.

Description.—Male (holotype) length 0.68 mm, female (allotype) length 0.80 mm, adult paratypes, mean: 0.70 mm. Color in alcohol spotted blue. Strong tegumental granulation. Dorsal reticulation present from head to abdomen V, except for intersegments (Fig. 29). Antennae shorter than head. Antennal segment I with seven setae, antennal segment II with 12 setae. Sensory organ of antennal segment III consisting of: (a) two small sensillae bent in same direction, (b) two subcylindrical guard sensillae (ventral one slightly longer than dorsal one), (c) ventral microsensilla situated above base of



Figures 29–37. *Caputanurina turbator* NEW SPECIES. Figure 29. Chaetotaxy and dorsal reticulation. Figure 30. Labium. Figure 31. Ocelli and postantennal organ. Figure 32. Postantennal organ. Figure 33. Maxillae. Figure 34. Mandible. Figure 35. Antennae III–IV. Figure 36. Antennae III, ventral side. Figure 37. Leg III.

guard sensilla (Figs. 35 and 36). Antennal segment IV with six thick subcylindric sensillae, dorsal external microsensilla, very small distinct subapical organite, apical vesicle trilobate (Fig. 35). Ocelli two + two, situated laterally, postantennal organ lateroventral, covered by integument folding, with 13–14 vesicles in single row (Figs. 31 and 32). Buccal cone ventral, short. Labium short, no L and B setae, labial organite (x) consisting of two + two strong hyaline sensillae one above the other between A and C setae (Fig. 30). Mandibles with five teeth (Fig. 34). Maxillae thin, maxillary capitulum with about 10 teeth, internal lamella shorter and thinner with two distinct teeth, the external one with two teeth (Fig. 33). Tibiotarsi I, II, III with 18, 18, 17 setae. Claws with only one tooth on lateral internal lamella, without ventral tooth (Fig. 37). Femur with long ventral setae, including one particularly long. Ventral tube with four + four setae. Vestigial furca reduced to two small mamelons usually with one + one setae (Fig. 40); two + one and two + two setae were also observed there (Figs. 41 and 42). Abdomen VI completely hidden under abdomen V. Female and male genital plates are presented in Figs. 40 and 42. Pseudopore in front of the plates. Adult males exhibit secondary sexual features: sternite IV, V and anal valves with some ramified setae (excepting internal genital pointed setae). Dorsal chaetotaxy, very varied (especially on Vth abdominal segment) is presented in Fig. 29: short thin pointed ordinary setae and long thin sensory setae, excepting air of shorter thicker sensillae on abdomen IV. Sensory chaetotaxy is "022/11111" per one-half tergite.



Figures 38–39. *Caputanurina turbator* NEW SPECIES, first instar. Figure 38. Dorsal and ventral chaetotaxy, do = dorsal organ. Figure 39. Antennae III–IV.

First Instar.—Antennal segment IV with fewer ordinary setae than adult, setae longer than segment length; sensillary chaetotaxy reduced to dorsal external microsensilla only, subapical organite and simple apical vesicle (trilobate in adult specimens) present. Sensory organ of antennal segment III complete (Fig. 39). Buccal parts are slender. Dorsal chaetotaxy (ordinary and sensory setae) on head and body same number, position and variability as in adults especially on abdominal tergite V (Fig. 38).

Diagnosis.—*Caputanurina turbator* has one lateral internal tooth in the claw and two teeth in the external lamella of the maxillae. The differentiating characters of the new species are presented in Table 4.

Discussion.—Our observations of the first instar on *Caputanurina turbator* confirm those of Gruia (1974) on *Endonura tatricola* (Stach 1951), of Dallai & Martinozzi (1980) on *Thaumanura ruffoi* Dallai 1969, and of Deharveng (1983) on *Bilobella aurantiaca* (Caroli 1910), *Neanura muscorum* (Templeton 1835) and *Vitronura giselae* (Gisin 1950). However, in two species of *Mesaphorura* Börner 1901, studied by Rusek (1980), the first stage differs from the other ones, including adult specimens, by chaetotaxy reduced in comparison with the adult pattern. In *Mesaphorura sylvatica* (Rusek 1971) and *Mesaphorura yosii* (Rusek 1967), even the postantennal organ, the sensory organ of antennal III, and the number of setae as well as sensillae of antennal IV are reduced.

The first instar of *Caputanurina turbator* already exhibits dorsal reticulation along the whole length of head and body, but observation with an optical microscope yields only one secondary grain, surrounded by reticulation, just as in the adult specimen of *Caputanurina intermedia,* while four to seven secondary grains are found in adult *C. turbator.* Moreover, a dorsal organ was observed on thorax I in specimens at stages I and II. This organite is characteristic for Neanuridae

Table 4. Characters differentiating species of the genus *Caputanurina* Lee, 1983.

Characters	*Caputanurina*				
	intermedia NEW SPECIES	*serrata* Lee, 1983	*turbator* NEW SPECIES	*major* NEW SPECIES	*sexdentata* NEW SPECIES
Antenna II setae	12	?	12	12	13
Ventral guard sensilla—insertion type	without mamelon base large	?	without mamelon	on a mamelon	without mamelon
apical vesicle antenna IV	trilobate	trilobate	trilobate	trilobate	bilobate
Ocelli	3 + 3	2 + 2	2 + 2	2 + 2	2 + 2
Mandible teeth	5	4	5	5	6
Maxillae: maxillary capitulum teeth	8–11	9–10	10	11	10–12
External lamella	apex bent	?	long, 2 teeth	long, apex bent	7–10 teeth
Internal lamella	short, 2 teeth	?	short, 2 teeth	short, 2 teeth	long, thin apex pointed
Setae absent in labium	B	?	B	A	A
Setae in tibiotarsi I, II, III	18, 18, 17	?, ?, 17[a]	18, 18, 17	18, 18, 17	19, 19, 18
Tooth in claw	absent	absent	1 lateral internal	absent	absent
Setae in vestigial furca	1 + 1	2 + 2	1 + 1 (2 + 2, 2 + 1)	1 + 1	1 + 1 (2 + 1)
Length (mm)	0.40–0.54	0.6	0.68–0.80	0.88–0.93	0.67–0.70

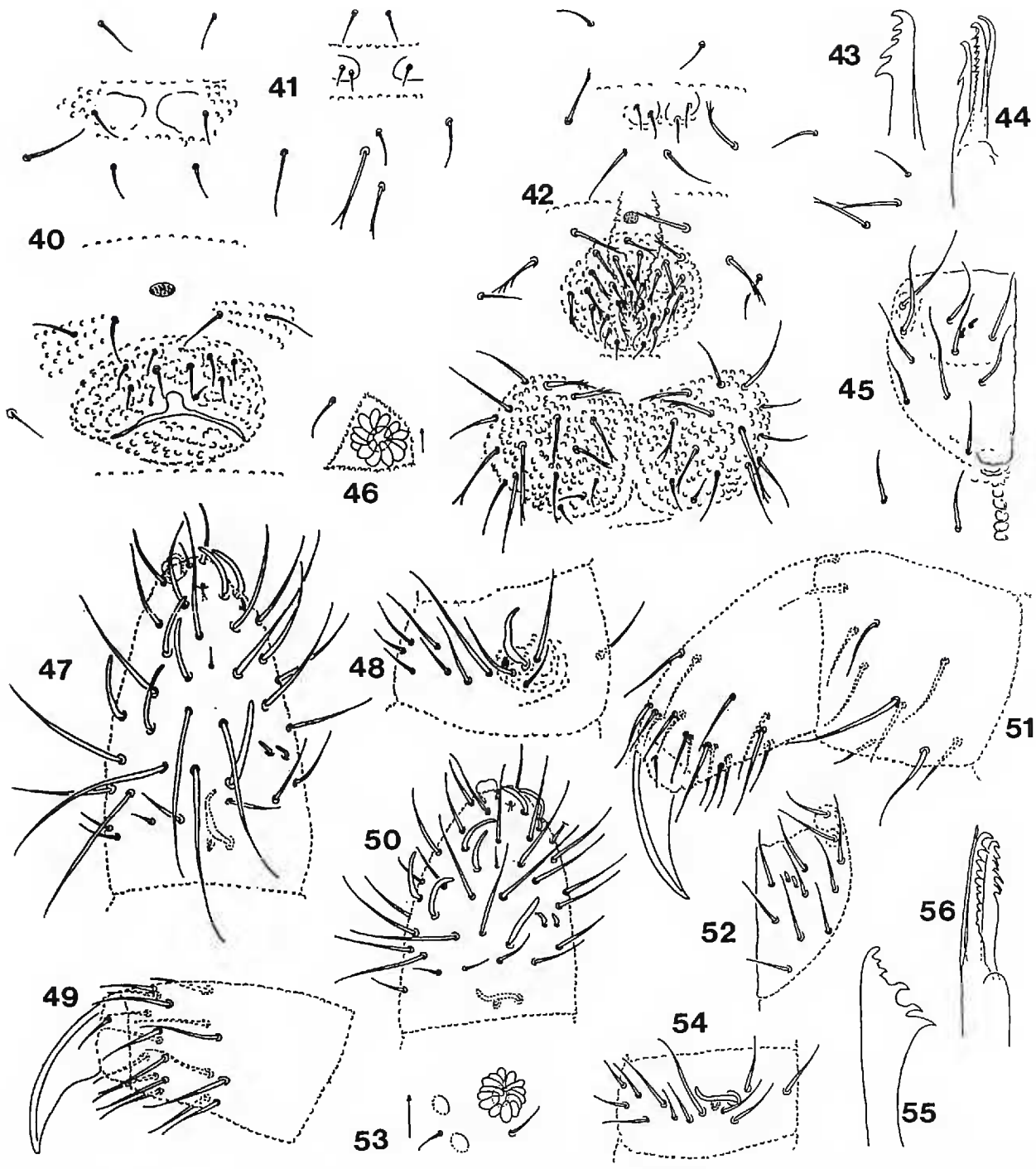
[a] After a figure by Lee (1983).

Neanurinae (Deharveng 1983) and Brachystomellinae (Najt, personal observation).

The odd dorsal organ is usually situated on the posterior limit of prothorax tergite. It is situated in the anterior intersegment of thorax II at its limit with posterior head margin (Fig. 38).

Etymology.—The name reflects the difficulties encountered while establishing the systematic position of the species.

Material Examined.—See types. In addition: NORTH KOREA. *NORTH PYONGAN PROVINCE:* Myohyang-san Mts, nr Yuson waterfall, forest with oak, maple, magnolia, pine, under rotting wood, 22 Jun 1981, A. Szeptycki & W. M. Weiner, 2 specimens; Hyangsan-chon river valley, at forest edge, under rotting wood, 23 Jun 1981, A. Szeptycki & W. M. Weiner, 1 specimen; Hyangsan-chon river, oak-chestnut-pine forest, litter among granite rocks, 23 Jun 1981, A. Szeptycki & W. M. Weiner, 15 specimens on slides, 4 specimens in alcohol; Vicinity of Sanju waterfall, forest, moss on granite rocks, 24 Jun 1981, A. Szeptycki & W. M. Weiner, 1 specimen. *SOUTH PYONGAN PROVINCE:* Paeksong-ri, forest with oak, chestnut, acacia, rhododendron, litter with oak leaves and pine needles, 15 Jun 1981, A. Szeptycki & W. M. Weiner, 1 specimen; litter with mycelium, 11 Jul 1981, A. Szeptycki & W. M. Weiner, 4 specimens. *KAESONG-SI PROVINCE:* Vicinity of Kaesong, valley among hills covered with acacias, pines, maples, moss on humid stones, 13 Jul 1981, A. Szeptycki & W. M. Weiner, 1 specimen.



Figures 40–56. Figures 40–42. *Caputanurina turbator* NEW SPECIES. Figure 40. Vestigial furca and female genital plate. Figure 41. Vestigial furca. Figure 42. Vestigial furca, male genital plate and anal lobes. Figures 43–49. *Caputanurina major* NEW SPECIES. Figure 43. Mandible. Figure 44. Maxillae. Figure 45. Labial chaetotaxy. Figure 46. Postantennal organ. Figure 47. Antennae III–IV. Figure 48. Antennae III, ventral side. Figure 49. Leg III. Figures 50–56. *Caputanurina sexdentata* NEW SPECIES. Figure 50. Antennae III–IV. Figure 51. Leg III. Figure 52. Labial chaetotaxy. Figure 53. Ocelli and postantennal organ. Figure 54. Antennae III, ventral side. Figure 55. Mandible. Figure 56. Maxillae.

Caputanurina major Najt & Weiner, NEW SPECIES (Figs. 43–49)

Types.—Holotype, male; data: NORTH KOREA. *NORTH PYONGAN PROVINCE:* Myohyang-san Mts, nr Sanju waterfall, forest with oaks, maples, magnolias, pines, wet litter, 24 Jun 1981, A. Szeptycki & W. M. Weiner. Allotype, female, same data as holotype. Holotype and allotype deposited in Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Cracow, Poland. Paratype, 1 specimen, same data as holotype; deposited in MNHN.

Description.—Male (holotype) length 0.88 mm, female (allotype) 0.83 mm, paratype 0.90 mm. Color

spotted blue. Dorsal reticulation present from head to abdomen V. Antennae shorter than head. Antennal segment I with seven setae, antennal segment II with 12 setae. Sensory organ of antenna III consisting of: (a) two small tubular sensillae bent in the same direction, (b) two subcylindrical guard sensillae (ventral s-shaped and shorter than dorsal, situated on tegumental mamelon, with three ordinary setae), small ventral sensilla in groove at level of guard sensilla base; ordinary ventral internal setae long (Fig. 48). Antennal segment IV with six long thin sensillae, dorsal external microsensilla, subapical organite distinct, apical vesicle trilobate (Fig. 47). Two + two blue-black ocelli in lateral position. Postantennal organ in ventral position, clearly hidden under tegumental folds with 14–15 vesicles in circle (Fig. 46). Buccal cone ventral. Labium bigger and stouter than in *Caputanurina turbator,* without L and A setae; labial organite consists of two + two hyaline sensillae distributed internally between C, D and B setae (Fig. 45). Mandibles strong, with five teeth (Fig. 43). Maxillae stout, maxillary capitulum with 11 very pointed teeth, internal lamella shorter, with two teeth; thin external lamella, with bent apex, lies along the claw (Fig. 44). Tibiotarsi I, II, III with 18, 18, 17 setae, with some of ventral setae, pointed dorsal seta very long. Claw toothless (Fig. 49). Femur with a very long ventral seta. Ventral tube with four + four setae. Vestigial furca reduced to two mamelons, each with one seta. Male and female genital plates resembling *C. turbator.* Two pseudopores can be found in front of genital plate. Adult males exhibit secondary sexual characters in setae of abdominal sternites IV–V and anal valves; only four + four internal setae pointed in genital plate. Dorsal chaetotaxy (similar to *Caputanurina turbator*): short thin pointed ordinary setae, long slender sensory setae (excepting pair of sensillae shorter and thicker on abdomen IV). Sensory chaetotaxy is "022/11111" per one-half tergite.

Diagnosis.—This new species is large. The ventral guard sensilla of the sensory organ of antenna III is situated on an integumental mamelon. The maxillary capitulum has 11 teeth, and the external lamella is long with the bent apex. Table 4 shows characters differentiating *C. major* from the other species of the genus.

Note.—Numerous specimens of this species were used in a study of cuticule under a scanning and transmission electron microscope.

Etymology.—The name refers to its large size.

Material Examined.—See types.

Caputanurina sexdentata Najt & Weiner, NEW SPECIES (Figs. 50–56)

Type.—Holotype, male; data: NORTH KOREA. *PYONGYANG-SI PROVINCE:* Ryongak-san Hill, oak-acacia forest, litter, 13 Jun 1981, A. Szeptycki & W. M. Weiner; deposited in Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Cracow, Poland. Paratype, same data as holotype, 1 male in ISEA.

Description.—Male (holotype) length 0.70 mm, paratype 0.67 mm. Color: very light blue from head to abdomen V in dorsomedian portion; spotted dark blue in dorsal external part; spotted light blue in antennae and legs; spotted blue in sternites; dark blue in ocular plate (females usually lighter). Strong tegumental reticulation from head to abdomen V. Antennae shorter than head. Antennal segment I with seven setae, antennal segment II with 13. Sensory organ of antennal segment III consisting of: (a) two small sensillae bent slightly in same direction, (b) two subcylindrical guard sensillae (ventral s-shaped), (c) one small ventral sensilla situated in small groove. Antennal segment IV with six subcylindrical sensillae, dorsal external microsensilla, subapical organite distinct; apical vesicle slightly bilobate (Fig. 50). Two + two ocelli in lateral position. Postantennal segment with 12–13 vesicles in circle in lateral position (Fig. 53). Buccal cone short. Labium as in *C. major,* without L and A setae, with labial organite (x) consisting of two hyaline sensillae between C, D and B setae (Fig. 52). Strong mandibles with six teeth (Fig. 55). Maxillae elongate; maxillary capitulum with 10–12 very pointed teeth; internal lamella, slightly shorter than claw, with 7–10 very pointed teeth; external lamella, of same length as claw, thin with pointed apex (Fig. 56). Tibiotarsi I, II, III with 19, 19, 18 setae, claws toothless (Fig. 51). Femur with very long ventral seta. Ventral tube with four + four setae. Vestigial

furca reduced to two mamelons, each with one seta. Adult males exhibit secondary sexual characters as in *Caputanurina major*. Dorsal chaetotaxy (similar to *C. turbator*) consists of short thin pointed ordinary setae, long slender sensory setae (excepting pair of sensillae, slightly shorter on abdomen IV). Sensory chaetotaxy is "022/11111" per one-half tergite.

Diagnosis.—The mandible of *C. sexdentata* has six teeth. Tibiotarsi with 19, 19, 18 setae. Table 4 shows differentiating characters.

Discussion.—Although all the species of the genus *Caputanurina* are similar, especially in color, habitat and dorsal reticulation, they differ in many features. The differences are summarized in Table 4.

Etymology.—The name refers to number of teeth in the mandible.

Material Examined.—See types. In addition: NORTH KOREA. *KAESONG-SI PROVINCE:* Chonma-san Mts, nr Pakjon waterfall, maple-oak forest, litter, 15 Jul 1981, A. Szeptycki & W. M. Weiner, 1 specimen in ISEA, 1 specimen in MNHN. *SOUTH PYONGAN PROVINCE:* Paeksong-ri, forest with oaks, chestnuts, acacias, rhododendrons, fairly dry litter, 15 Jun 1981, A. Szeptycki & W. M. Weiner, 1 specimen. *RYANGGANG PROVINCE:* Nampotae-san Mt, mixed forest with birch and larch, under (granite) stone, 8 Sep 1971, A. Szeptycki, 1 specimen.

Discussion and Conclusions

The subfamily Caputanurinae is unique among Neanuridae s. 1. and even among Poduromorpha in its exceptional characters: reduction of thorax tergite I and fusion with the base of the head.

As a result to the tendency towards "cryptophthalmy," the head has migrated ventrally and forward. The aperture of the buccal cone has also become ventral; the occipital part moved towards the vertex while thoracic tergite I became fused with each dorsolateral margin of the head. This tergite shows a reduction to two + two or three + three lateral setae. A tendency towards "cryptopygy" also appears: abdomen VI becomes invisible under abdomen V. Simultaneous emergence of the two tendencies results in a dorsal flattening of head and body. This character is found in *Leenurina*; it is very pronounced in *Caputanurina*.

We believe that environmental adaptation may have appeared in the past, and this the type of dorsally flattened body with its withdrawn fragile sensory organs (eyes, postantennal organ, antennae), might be the result of adaptation to a more sedentary and concealed life style.

Moreover, the group studied here exhibits dorsal reticulation, a trait that seems to be the result of ecological convergence and thus probably represents a homoplasy. This feature is also present in the Isotomidae, Onychiuridae, Hypogastruridae, and in other groups of Neanuridae. However, while dorsal reticulation appears only sporadically and independently in various genera of these families, it is a phylogenetically stable trait in the whole lineage of Caputanurinae.

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